Automatic Cocktail Dispenser

ECE 445 Project Proposal

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1. Introduction

1.1 Objectives and Background

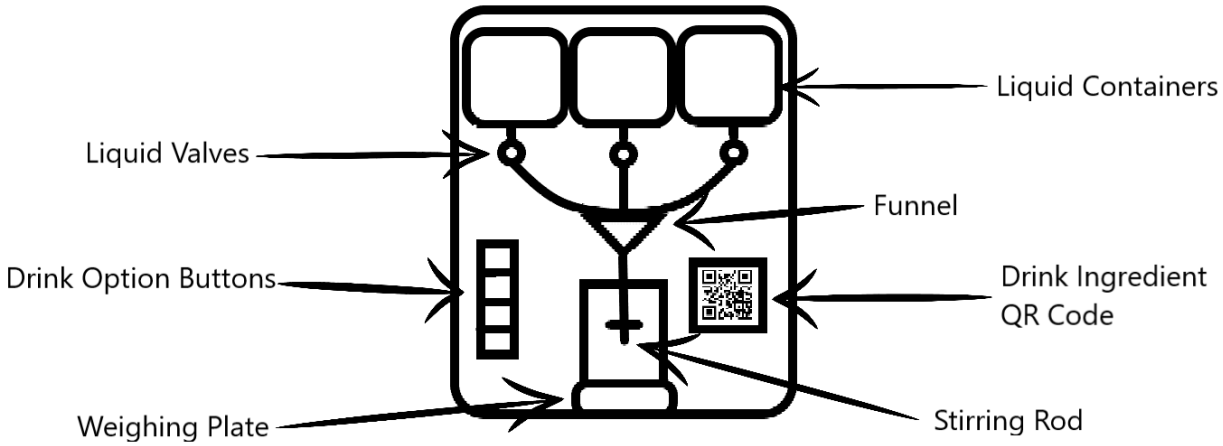
Cocktail drinking is a common activity among eligible adults, but there can sometimes be a knowledge barrier where people have trouble making their own drinks. This product will solve common issues like inexperience and time inefficiency by making cocktail production more convenient and simple for users everywhere.

This product will be able to produce a few different cocktails and correctly dispense the ingredients to produce a drink in a quick and efficient manner. This product would be beneficial to consumers everywhere because it eliminates the effort and time that goes into manual cocktail production. By saving time, this product would allow users to spend more time socializing with friends instead of having to step away and make drinks themselves.

While an automatic cocktail dispenser is not a novel idea, the design is certainly unique. Rather than a Keurig-style design, where a small cup with concentrate is placed into the machine, this cocktail creator will be able to take the liquid out of reusable containers that the user pours the alcohol/mixers into. This design not only reduces waste from the Keurig cup design, but also lowers the cost since pre-mixed cocktail concentrate cups are no longer necessary. The main features of this product are as follows: a simple interface involving a couple of buttons, a stirring rod, and simple tubing.

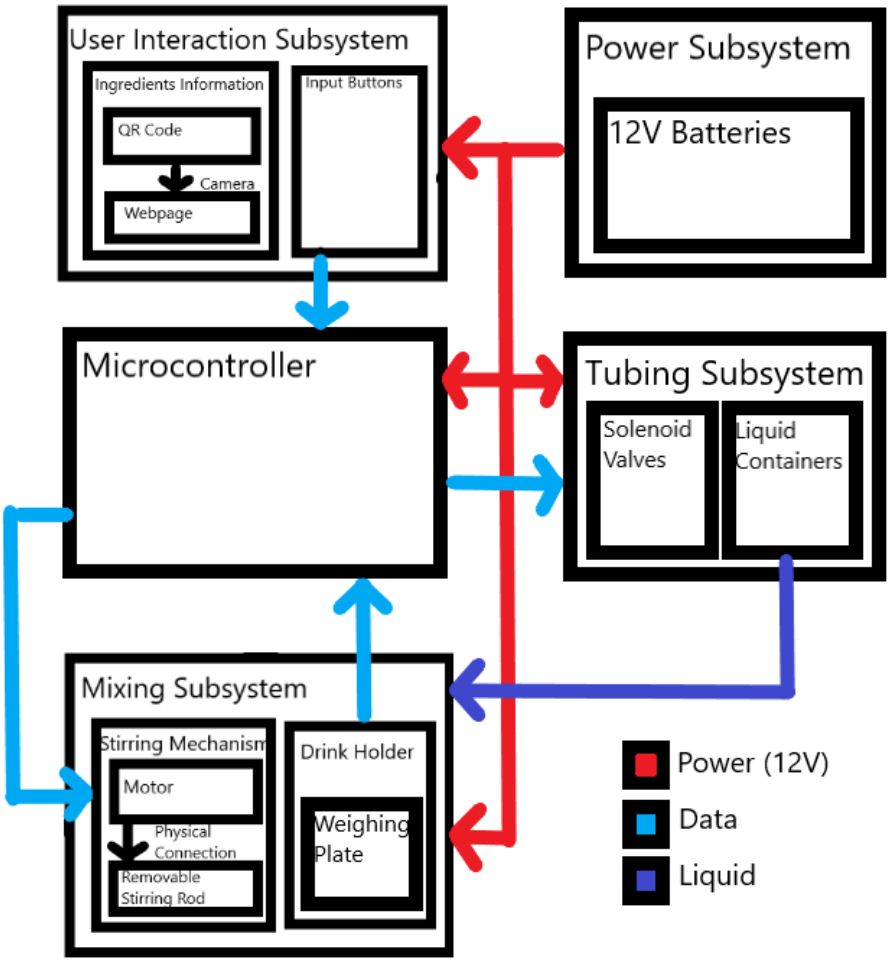
1.2 High Level Requirements

- The product must be able to dispense the user's chosen drink with no selection error.
- The product must dispense the correct quantity of each ingredient for each respective cocktail with ~10% accuracy.
- The stirring rod properly mixes the drinks after a successful dispense (test with food coloring water to see if the color is uniform).



2. Design

2.1 Block Diagram



2.2 Block Descriptions

2.2.1 User Interaction Subsystem

- A user interface provides the user with a way to communicate with the cocktail machine. The QR code on the device will work as a drink menu, allowing the user to scan, view, and choose a cocktail recipe and requiring them to then add the designated ingredients to the liquid containers. The buttons on the device allow the user to select how much alcohol they want in the cocktail - a single shot, a double shot, or even a mocktail (no alcohol at all). The selected option will be displayed through LEDs, and there will also be a dispense button, the selection defaulting to mocktail on startup.
- Requirement 1: The button choice must dispense the correct alcohol quantities that the user selected.
- Requirement 2: The QR code should be scannable and lead the user to a functional website
- Requirement 3: The alcohol content should default to the non-alcoholic “mocktail” setting and LEDs must accurately show current selection

2.2.2 Power Subsystem

- Provides power to the system through 12V batteries, powering the user interface system, the electric solenoids, and the mixing subsystem. Power must be converted to 5V for components such as the microcontroller and current will need to be properly regulated for our gear motor.
- Requirement 1: The batteries must provide 12V to each component that requires it.
- Requirement 2: The voltage must be accurately stepped down to 5V for each component that requires it
- Requirement 3: Current must be regulated for our gear motor to prevent any stalling

2.2.3 Microcontroller

- Receives user input from user interaction subsystem and outputs data to tubing and mixing subsystems, to dispense correct liquid quantities for the selected cocktail and mix accordingly. The data it receives during a dispensing cycle will originate from a load cell sensor that detects how much liquid is dispensed, by measuring the liquid’s mass. This is being used since a time-based release is inconsistent and doesn't account for air bubbles.
- Requirement 1: Dispense ingredients serially.
- Requirement 2: Dispensed liquid must be within +/- 10% error of desired mass.

2.2.4 Tubing System

- Connects containers of ingredients through a system of tubes and an electric solenoid for each container. These tubes will lead to a funnel that will output into the user's glass. The electric solenoids, chosen to be a 12V DC Electric Solenoid Valve, will be connected

to the microcontroller in order to dispense the correct ingredient and their exact quantities. The liquid ingredients will be poured independently, and this will also be controlled by the microcontroller.
- Requirement 1: Tubes and the solenoid valve must not leak.

2.2.5 Mixing Subsystem

- Stirs the dispensed ingredients so they are mixed thoroughly. The stirring mechanism will be a rod powered by a small gear motor, the Greartisan DC 12V 50RPM Gear Motor High Torque Electric Micro Speed Reduction. The stirring rod will be removable in order to facilitate cleaning, as well as have small blades in order to facilitate better stirring.
- Requirement 1: The gear motor must be within +/- 10% of 50 RPM.
- Requirement 2: The drink holder must be stable enough, such that when the stirring mechanism is active, the holder will not fall over.

2.3 Risk Analysis

The piece of the block diagram that poses the greatest difficulty is the tubing system. The backbone of the project is the automated transportation of liquids, so successfully implementing this will be the biggest hurdle. Ensuring the correct amounts are dispensed, as well as preventing leaks, are crucial requirements that could lead to immense risk if not performed correctly. Dispensing too much alcohol or leaking liquid over the design poses the greatest dangers, so using extra caution when implementing these parts will be extra important to ensure the safety of the users as well as the creators. To further prevent liquid-electronic interaction, the User Interface (buttons and PCB) will be mounted away from any tubing.

3. Ethics and Safety

According to 7.8 IEEE Code of Ethics, it's important to "hold paramount the safety, health, and welfare of the public" as well as "disclose promptly factors that might endanger the public or the environment."[1] In regard to this project, it's important to disclose to the public the dangers of alcohol consumption and inform them to drink at their own discretion. Alcohol can have dangerous consequences when drunk irresponsibly, so safe consumption is needed to preserve the safety and health of the public. This topic will be made very clear when presenting the product. In terms of safety, there's always going to be a hazard when dealing with both electrical equipment and fluids, so using extra precaution is going to be essential to avoid disaster.

According to the University of Illinois's "Electrical Safety in a Research Laboratory", there are a lot of general electrical safety recommendations to follow, especially given the project at hand. Some of these recommendations include wearing appropriate PPE, minimizing electrical use in areas of high moisture, unplugging equipment before adjusting any pieces of the project,

etc.[2] Extensive measures will be taken to ensure that all of these recommendations will be taken seriously and enacted effectively.

Lastly, there are several federal regulations that are crucial to the safe manufacturing of our product, most of them similar to the campus policies. In particular, there is an emphasis on ensuring the equipment being used is up to standard and has no “physical irregularities that can adversely affect the insulating properties" of such equipment.[3] No matter the situation, using faulty equipment increases the opportunity of injury, so ensuring that the electrical equipment works properly is a major step that needs to be taken every time when working in the lab.

References:

[1] https://www.ieee.org/about/corporate/governance/p7-8.html
[2] https://drs.illinois.edu/Page/SafetyLibrary/ElectricalSafetyInTheResearchLaboratory
[3] https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.137